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ABSTRACT

A majority of today's college students face circumstances that make it difficult to study full time on campus. They are usually 25 years old or older and may have jobs, children, or impairments to their mobility that prevent them from attending college easily; however, there are ways in which colleges and universities can help these students by changing the uses of educational resources. For example: (1) direct instruction, usually conveyed by lectures and textbooks, may be in the form of correspondence materials and video, or telecourses; (2) live conversation with faculty and peers may take place through audio conferencing, involving only sound, or through audiographic conferencing where visuals may be added through a computer link; (3) other exchanges of ideas and materials with faculty and peers can take place over electronic mail, computer conferencing, fax machine, and voice mail; and (4) learning by doing can be emphasized through online library services, computer assisted design programs, word processors, statistical packages, and other technology-based resources. The evolving college is an institution that is more open to the outer world with shared resources and services, and promotes collaboration between faculty, students, and institutions. (6 references) (DB)

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REACHING STUDENTS, REACHING RESOURCES: Using Technologies to Open the College

by

Stephen C. Ehrmann

23 Feb 1990

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Reaching Students, Reaching Resources:
Using Technologies to Open the College

Stephen C. Ehrmann
The Annenberg/CPB Project

Colleges have to reach students before they can teach them.[1] That's not easy these days. It's a problem of distance, but also of schedule. A majority of today's undergraduates face one or more of the following circumstances that make it difficult to study full-time on campus:

- a job;
- children to raise;
- impairments to their mobility;
- a home distant from any college that offers the calibre of program they want and need; or
- other conflicts with the traditional schedule and location of full-time college study, such as still being in high school.

Some learners somehow surmount these barriers and enroll, if only part-time. Many other potential students find such barriers too severe, and are not currently enrolled.

A recent report from the Pew Higher Education Research Program calls learners like these "the New Majority." They're undergraduates either twenty-five years old or older; under twenty-five but studying part-time; or stopping out and in. They are a more diverse lot than full-time students of traditional age: varied in their strengths, their experience, their economic and racial characteristics. Courses that are designed to teach 18-year olds may not be well-designed for the New Majority.

The label of "distant learners" is has been hung on many of these students. It is true that distance must often be bridged in order for them to learn. But many of them live quite close to a campus. Scheduling is more often their major problem. These students don't have time to waste in commuting (and finding a parking place) in order to:

- register,
- seek financial aid,
- attend a lecture,
- browse in the library,
- attend a seminar,
- work three hours in the laboratory,
- participate in a project meeting with other students,
- attend another class,

-- back and forth, trip after trip.

These are not learners whom colleges can afford to shortchange. Their time is valuable. Their tuition should not be used to subsidize the studies of "real" students. These *are* the real students. Many are working adults who want to enrich their

[1] This article will appear in the March 1990 issue of *Academic Computing*. Opinions expressed here are those of the author and do not necessarily reflect funding priorities of the Annenberg/CPB Project. Responses may be sent to the author at the Annenberg/CPB Project, 1111 16th Street, Washington DC 20036 or, after March 30, 1990, at the Annenberg/CPB Project, 901 E Street NW, Washington DC 20004. The author's bitnet address is EHRMANN@UMDC.

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careers and their lives. They are not just our world's future. They are its present.

Some colleges are already using common information technologies to offer academic programs that are more open to this New Majority.

Thus far, most of them have reached out for students by emphasizing one of four ways in which students can use learning resources:

1) studying textbooks, lectures, videotapes, and other *direct instruction* about the content of the course, or

2) *conversing* with faculty, students and distant experts in *real-time* (i.e. "live"), or

3) exchanging ideas and materials with faculty, students, and others over a period of hours and days (call this *"time-delayed conversation"*), or

4) working on a realistic problem in order to *learn by doing*: by acting and reflecting.

1. Direct Instruction

Direct instruction informs the student about the subject matter of the course: what it is, how one might think about it.

On campus, direct instruction is usually conveyed by lectures and textbooks. Direct instruction (as opposed to conversation, which we'll discuss below) is received by the student as a one-way message which can then be studied.

For the New Majority (back when they were still a minority), the first great technology of direct instruction was the U.S. Mail, bringing them print correspondence materials. More recently video has been used to complement print. About half a million students each year register in courses that offer a combination of print and video materials. Some of those telecourses are distributed nationally (the Annenberg/CPB Project has funded many of them), while others are produced by a college for its own students.

Research indicates that video can convey what a traditional lecturer plus lecture hall can, plus a great deal more. Video can display lectures and data from the past and from a distance, magnify live demonstrations and replay them in slow motion, show a close-up of the faculty member's face and gestures, and, most wonderful of all, give each student the power to pause, to rewind, and to view the instruction at comfortable times and places.

Telecourses can be used by traditionally organized colleges, but video technologies also make possible new kinds of colleges.

Take, for example, a six year old university that is growing so rapidly that it may soon become one of the ten biggest engineering graduate programs in the country, with an operating budget that is already topping $10,000,000/year. Yet ground was broken for its first building only in 1989. That's because both its faculty and students are scattered all over the country.

The institution is the National Technological University (NTU), headquartered in Fort Collins, Colorado. NTU is a product of the collaboration of twenty-nine universities around the country, institutions

such as Arizona State, Georgia Tech, the University of Maryland, Northeastern, and Rensselaer Polytechnic. In member college classrooms equipped with cameras and linked by satellite dishes to NTU's transponders in orbit, faculty teach their normal courses. Using four color video channels, NTU broadcasts these courses live to over 275 industrial sites around the country. At these sites, NTU students study in seven graduate programs in engineering and management, or take related credit and noncredit courses. Undergraduate coursework is delivered this way as well. Corporate subscribers range from Alcoa and AT&T to US West and Xerox.

NTU is growing fast and recently received regional accreditation. The teaching has been good enough that a recent course evaluation found that 54% of NTU students felt that their faculty member should receive an "outstanding teacher" award.

Broadcast of direct instruction is the most frequent way in which technologies have been used to reach New Majority students. The second most common application of new technologies supports a more conversational style of learning.

2. Real-Time Conversation

Some programs for the New Majority have focused on supporting frequent, live conversation with other students and the faculty member.

The instructor can coach and critique in real-time as a student thinks through a complex problem. Students can learn as they debate one another, or engage in a role playing simulation. A team of students can learn by tackling a project so complex that no one of them could accomplish it alone. Technology can make it possible for students to take part in such real-time discussion and collaboration, even though they are scattered across the landscape.

A common technology for supporting real-time conversation is audio conferencing. Every room with a telephone becomes a potential classroom. More sophisticated audio equipment is used for larger groups of students.

But audio conferencing has a major drawback: participants cannot see what they are talking about: the text of an essay, equations on a blackboard, elements of a painting, a demonstration.

So colleges have sought ways to give a visual dimension to conversation at a distance. Video can let everyone see and be seen. But that is usually prohibitively expensive, especially if more than two sites are involved.

Audiographic conferencing provides a more affordable way to support the visual dimension of a conversation. Two or more sites are equipped with phone lines, audio equipment, computers, and modems. By using special software, the computer screens at each site can show the same image to all participants, simultaneously.

I recently visited one of the six sites in the University of Maryland University College's audiographic network, and sat in on a computer

science course. A touch of the faculty member's graphics tablet brought up the same flowchart on each computer screen at each site. That flowchart, with many other drawings and outlines, had been stored on the students' diskettes in advance. But, if the faculty member had wanted to improvise, the system could also have sent the screen image over the telephone lines.

As the faculty member talked, he used the on-screen cursor to point. Students in five other sites scattered across eastern and southern Maryland could hear him and see where he was pointing on the flowchart on their computer screens.

He then called on a student. She sketched a new element to the flowchart, using her site's graphics tablet. Her response could be seen and heard by all participants.

For a large class, audiographic conferencing can support some aspects of real-time interaction more effectively than a traditional classroom. This computer science course had almost thirty students but, each time the faculty member asked a question, no time was wasted silently waiting while a student walked down a row of seats and over to a blackboard. Instead, in the audiographic class, every student was within arm's length of the "blackboard" so the Socratic dialogue could flow quickly.

The Maryland program is rapidly expanding the number of sites it serves (two when the program started last year; six now), the number of courses taught this way (seven in spring 1990), and its enrollments (216 registered this spring, of whom 109 use the five sites distant from the University).

3. Time-Delayed Conversation

Real-time is not the only desirable tempo for conversation. Electronic mail and computer conferencing can allow the exchange to take place at a slower rhythm,with each person taking part at times that are personally convenient. Other new technological vehicles for *time-delayed conversation*: the fax machine and voice mail.

In a time-delayed conversation, students can spend as much time as they like thinking about the dialogue thus far, and exactly what they want to say next:. There is no artificial advantage for the people most adept at leaping into the fast-moving stream of real-time talk. Computer conferencing is therefore an especially friendly medium for foreign born students and teachers. The ability to "leap in" is not artificially favored, and the problem of understanding one another's accents is removed. Special software and hardware can even allow the deaf to take part on an equal footing, as students or faculty.

Prof. Starr Roxanne Hiltz of the New Jersey Institute of Technology (NJIT) has been doing research on the educational applications of computer conferencing for education for years. Most students in her studies have found conferencing to provide as good or better a medium of instruction than traditional classrooms.

NJIT's EIES conferencing system (pronounced "eyes") has been used by

a number of other colleges around the country to offer courses to students on their campuses and off. Packet switching networks do not charge by the distance of a call, so a California college pays no more than a New York college to use a host conferencing system in New Jersey.

Perhaps the most ambitious of these programs is Connected Education. Since the Fall of 1985, Connected Education has offered more than 110 courses entirely via computer conferencing for graduate and undergraduate credit in conjunction with the MA in Media Studies Program at The New School for Social Research, and for several programs at Polytechnic University in New York City.

Connected Ed also offers an extensive online library; a book-ordering service; connections to other online databases and library catalogs; and a computer conference called "Cafe," an electronic watering hole for distant friends who have never seen each other.

4. Working on Realistic Problems

The fourth, and least common, type of program for the New Majority uses technology to support *learning by doing*. On campus:

- a budding literary critic learns by reading novels and writing essays,
- a science student learns by doing research in a laboratory,
- a painter learns by painting.

Such action and reflection can teach skill, clarify and alter values, and foster deep insight.

Technologies are now enriching experiential learning. On campus, of course, there are online library services, computer-aided design programs, word processors, statistical packages, and thousands of other technology-based tools and resources for the practice of scholarship.

Technologies are also opening up new possibilities for learning by doing for students off-campus, too. For example the University of Virginia is using computer conferencing to help its student teachers stay in touch with on-campus mentors. Institutions such as the University of Illinois now use telephone lines to offer students online library services for finding and obtaining books and data. As more powerful and portable tools and resources become accessible, the opportunities for New Majority students are enriched.

A whole academic program that focuses on making learning-by-doing accessible has been developed Roger Boston and his colleagues at Houston Community College. As with the student teachers mentioned above, computers and modems are used to help the students stay in touch with faculty and other students, but at Houston, the computer becomes a tool for experiential learning as well.

Their modem-based courses are each organized around a sequence of complex problems, one of which is sent to the student each week via modem. The students, who are

scattered all around the metropolitan Houston area, then spend the week:

- learning enough to work the problem,
- trying out solutions, and
- communicating with the faculty member and one another about the work (also via modem).

Their solutions must be turned in by week's end, and the next week brings a new problem, and new direct instructional materials with it.

Data processing faculty, for example, assign programming tasks, while economics involves work with a spreadsheet and philosophy requires that students write essays.

Enrollment has grown quickly to over 110 students in 7 courses this past fall. Technical support for the host conferencing system and the need to train faculty and to develop new styles of courses have been limiting factors. So far enrollment has been best in data processing courses, perhaps because courses are advertised through Houston's huge PC users group.

Four Ways to Use Learning Resources

What's next for higher education? If the programs described thus far are steps along a pathway, where is the path heading?

Each type of program described so far has emphasized a different way to use learning resources:

1. Studying direct instruction, or
2. Conversing with others in real-time, or
3. Exchanging materials and ideas over hours and days; or
4. Learning by working on realistic problems.

Each of these processes is a facet of academic conversation: the open-ended interplay between an inquiring, critical mind and the unfolding possibilities of a situation. Many teachers, going back to Socrates, have exploited the similarity of a dialogue between people and the silent mental dialogue that an expert uses to think. For that reason, I'll use the shorthand of *the four conversations* to refer to these four ways of using learning resources.

(Insert figure 1 about here)

On campuses, in contrast, the four conversations are all supported. Study of direct instruction provides the framework for understanding. Real-time conversation helps quickly resolve ambiguity, and to support team projects. Time-delayed conversation is needed to give everyone time to think before responding. And thoughtful learning by doing provides the deeper insights and more complex skills that come only when the novice begins to imitate the expert, and then to carve his or her own path.

The cases we've discussed so far have each focused on one of those four conversations. Each program has had to focus on just one major technology, a technology whose strength happened to be that one conversation. For example, NTU is strong in direct instruction for large groups because its major technology is satellite transmission of video. Maryland is best able to support real-time conversation in small groups; its core

technology is audiographic conferencing.

Academic programs have found it easier to focus on just one technology, because each technology has been expensive, unfamiliar to most faculty, and difficult enough that it required technological feifdoms in colleges, each organized around a particular type of machine.

In the last year or two things have changed. Many institutions are now comfortable enough with a variety of technologies that they can support the four conversations simultaneously for New Majority learners.

In fact, each of the four academic programs that we've already described actually does support the other three conversations, albeit to a lesser degree.

For example, NTU relies mainly on the broadcast of video-based instruction to large classes, but it also uses fax and electronic mail to support time-delayed exchange. For real-time conversation, students can ask questions of the faculty by phone if they take the classes live; if there happen to be other students at their site taking their course, they can converse with them, too. As far as learning by doing goes, NTU students are usually pursuing degrees related to their current work so there are many opportunities to apply what they are learning.

A few colleges have gone further still. One example is the Rochester Institute of Technology where faculty have considerable latitude in selecting technologies and in using them to teach New Majority learners.

Prof. Dave Medvedeff, for example, teaches "Introduction to Computers and Programming."

He handles direct instruction with textbooks plus *The New Literacy*, an Annenberg/CPB telecourse.

Using the Notes computer conferencing system, Medvedeff asks questions that point up issues that he wishes to emphasize in the video and text. Medvedeff likes the conversation that computer conferencing engenders. "I do think it's good that students see how other students answer questions....I don't say in the conference what a bad answer is. I think they can tell the difference. That understanding carries over into the exam." Students can use electronic mail for more private dialogue with the faculty member and one another.

Learning by doing in a computer course involves programming and use of applications software. Many students use their own machines for assignments, but the mainframe that provides the conferencing is also used extensively.

Before each exam there is an optional audio conference for review. Students can participate from home or work, which helps increase participation. About three-fourths of the class usually takes part in the audio conference. "Students like them so much that they've asked for more," commented Medvedeff. "You could use a computer conference for that, but it would lack the immediate feedback."

The only problem with the audio conference is the lack of a visual dimension; Medvedeff wants to use

RIT's picture phones, a kind of inexpensive fax machine that the Institute lends to students (just as it now lends modems and other equipment). Hooked to a phone, it can send an image of a student's paper or photograph to all other participants in an audio conference in 3-4 seconds.

Medvedeff's course is tailored to reach students in their homes and offices. Other RIT courses use outreach sites at places such as schools and community colleges. The sites can house the equipment for audiographic conferencing, as well as offering proctors and other sorts of support.

Use of other accessible learning resources is also on the upswing at RIT. Use of on-line library services, for example, has increased by a factor of four in the last year.

RIT is by no means unique. Since its inception in 1984, Utah State's COM-NET system, for example, has evolved from a single network of nine sites to two networks with a total of 35 classrooms spread across the state, and two other sites out of state. Each COM-NET site is equipped with a variety of technologies to support the four conversations, including slow scan video, audiographic conferencing, fax machines, and remote library services.

The sites (called "centers") play many roles. According to director Louis Griffin, they also provide space for meetings and "handle student enrollment, text and syllabi purchases, aid in student utilization of the library resources and student counseling. For the distance education student, the centers become a mini-Utah State campus, providing the same services an on-campus student can receive."

COM-NET serves about 1000 students each quarter, and offers eight degree programs. Many of its courses are also available on a four-state network called the Intermountain Community Learning and Information Services (ICLIS).

In addition to these and other examples in this country, there is an even longer and more ambitious history of supporting the four conversations by institutions in Canada and other countries. The Contact North program in Ontario, for example, involves a collaboration of four institutions of higher education and a network of over thirty outreach sites, equipped with a variety of technologies mentioned in this article including video, personal computer tools, and audiographic conferencing. During 1988-89 Contact North offered 20 secondary school courses, 131 college level courses, and 52 university courses. Total enrollments topped 3,000 students.

Possibilities for Better Teaching

Programs like those at RIT, Utah State, Houston CC, NTU, and Maryland are including new students in the academic community. There is also anecdotal evidence that attrition rates may be lower than those in correspondence and telecourse programs. The faculty I've talked to are reasonably satisfied that the quality of their teaching is at least comparable to what they would offer on campus.

Now that such programs are beginning to establish the possibility of using the technologies to improve enrollments, it is time to consider another, equally exciting possibility.

HYPOTHESIS: The same technologies that can be used to reach more students can also be used to provide a richer and more effective environment for teaching and learning, especially for internalizing complex ideas and skills that the student can then apply in novel situations.

There are several reasons to suspect that this hypothesis is worth exploring:

1) Tools and resources of scholarly and professional work are becoming more portable and "communicable" so students can more readily tackle real or realistic problems (no matter where the students are, and when they are working).

2) A greater emphasis on studying and thinking on one's own tempo may give students more time to think, and to rethink their assumptions (no matter where the students are, and when they are working).

3) The conditions of study can be more intimate and supportive, even for students in large classes (no matter where the students are, and when they are working).

4) Students learning from their homes or workplaces may be more able to relate formal learning to their lives.

1) More, Better Tools and Resources: Technology lengthens the New Majority's reach for the tools and resources of scholarship and professional work. One example, described in some detail in the January issue of *Academic Computing*, is PERSEUS. Two optical discs will offer an wide range of primary texts in Greek and English, high resolution video images of Greek artifacts and sites, reference works, and research tools for the serious study of classical Greece. This interdisciplinary collection of resources is so rich that no student could find its like in any single college or museum in the world but in December 1990, PERSEUS will become available for any college, library, outreach site or individual with an appropriate computer, CD-ROM drive and videodisc player. This Annenberg/CPB-funded product should cost around $100.

(insert figure 2 about here)

The technologies also expand the students' reach for human resources. Nick Eastmond of Utah State has used the COM-NET system to include "visiting" experts from around the country in the audio conferences of his courses. Faculty at NJIT have used EIES conferencing to include anonymous corporate participants who could then talk candidly about conditions in the real world. Networking could send student projects out to distant experts for assessment.

2) Time for Thought: Time-delay also seems to help students think. The chance to pause before participating lets students consider what other have said, and what they want to say next. I'm told that there is a philosophy

faculty member at RIT who only half-jokingly has said that he will only talk philosophy with undergraduates using computer conferencing.

3) A Supportive Learning Community: A supportive learning environment can help students see ideas in a new light, and there is anecdotal evidence that these networks help students feel closer to one another and to the faculty. Linda Roberts of the US Congress's Office of Technology Assessment tells the story of a visit to a site in the COM-NET system a couple years ago. The students said they felt especially close to the faculty member. It always felt like the faculty member was talking in a special way to their own small group, they said. They even threw a party for the faculty member when he came to their site to teach to the network. (As with other networked programs, COM-NET faculty sometimes travel to the outreach sites to teach, rather than always participating from the home campus.)

I've heard similar reports of increased intimacy and community in classes conducted by computer conferencing. Students often feel a bond to their conversational partners, sometimes asking to continue in the conference even though they are dropping or flunking the course. Norm Coombs of RIT is one of several faculty who have reported that students also seem to have an easier time talking about sensitive issues such as race when they cannot see one another or the faculty member.

4) Learning in the Context of Life: Sue Rogers, Director of Distance Learning at RIT, tells me that several RIT faculty have noticed that their off-campus students seem more able to relate instruction to their personal experience and to transfer what they learn to new situations. The reason may lie in the location of the learning -- home or workplace. Students may find it easier to integrate instruction into their view of life when they are sitting in the middle of that life, Rogers speculates, and it is certainly easier to assign students class projects if they can do the projects as part of their jobs.

Strategies for Change

It would indeed be lovely if the structures created for reaching new students could also enable colleges to make significant steps forward in their teaching. It will not be an easy path, however. This essay concludes with two of the major strategic problems that need to be dealt with: a) obtaining needed equipment, and b) providing for adequate training , faculty development, and materials development.

a) Machines for the New Majority:

The experience of these programs suggests four complementary strategies for assuring access to equipment:

1) Recruit students with access to equipment.
2) Lend needed equipment.

3) Share sites with institutional partners.
4) Mount a program large enough to use equipment efficiently and successful enough to "earn" more.

1) Recruit students with access to equipment: Houston Community College distributes its marketing materials to the thousands of members of the area PC users group. This way it can enroll students that already have machines and want to use them for learning. Other institutions have used similar strategies. It helps that personal computers and VCRs are becoming more and more common in homes and workplaces.

2) Lend equipment: As already mentioned, RIT is one example of a college that lends picture phones, modems, and other needed equipment.

3) Share sites with institutional partners: Outreach sites are often located at other institutions that also have an interest in the education of local students. Institutional partners have included local businesses, libraries, other colleges, and community organizations. Perhaps the most important partner is the public school. A network of schools and colleges can provide college credit courses to high school students, inservice education for teachers, and college courses for adults in the neighborhood. Sharing facilities with schools also raises some difficult questions, such as which public and private colleges will gain access to particular school facilities, and vice versa.

4) Mount a program large enough to use equipment efficiently and successful enough to "earn" more: On-campus use of technology usually blooms from single teaching applications by single teachers. "Distance" programs too often offer a scattering of unrelated courses. In each case the result is the same: benefits for individual students are usually so small that they are hard to measure.

Colleges should consider focusing some of their technology investments on particular clusters of courses and services so that benefits for individual students will become tangible as they move through their academic programs. Such focus could make it easier to get, maintain, and add to equipment. First, the equipment could be more fully utilized, since many courses could be taught at the same outreach sites. Second, larger classes could help justify the development of higher equality teaching materials (especially if several colleges collaborated in developing programs). Finally, once investment in a single student's education reaches a critical mass, the institution's constituencies and benefactors can more easily perceive any resulting improvements in enrollment and educational outcomes. If the benefits of this year's investment are more clear and palpable, justifying next year's investment and expenses is that much easier.

b) Training, Faculty Development, Curriculum Development

Programs often underestimate how much training faculty and students will need in unfamiliar technologies.

Equally important, if the technologies are to support higher order learning, faculty will need to take a fresh look at the structure and content of their courses.

Much of this reconsideration will be unique for each course, but two more generic observations are possible.

First, faculty will often want to use conferencing to provide support and coaching, but it is impossible for the instructors to be half of every conversation for every student. One obvious alternative: get the students working together. An effective strategy is to develop assignments that students must handle as teams, assignments that engender the conversations that students need to have. It will take time and energy to develop curricula organized around such assignments, and more time and energy for instructors to learn how to facilitate group work.

Second, these technologies allow departments to exploit video, software, and other resources developed elsewhere. It takes time and resources to find and evaluate these resources, and to integrate them into local courses.

(insert figure 3 about here)

Concluding Questions

These programmatic improvements may represent an evolutionary step in the structure and image of colleges.

It would be a step away from the image of the college as cloister, where students retire from the world for four years of full-time study, walled-in with a full-time faculty and with academic resources entirely owned by the college.

The evolving college is more open to the outer world. Education is just one,continuing part of its students' lives. Its faculty are not all full-time: some have other jobs, even other careers. The books in its libraries are not there full-time; interlibrary loans and electronic network give the student a share in a national storehouse of resources. Many of its resources and servides are shared, and some are collaborative creations. In some cases colleges may even cooperate in creating and offering degree programs which no one of them could sustain.

This open, sharing college faces challenges every bit as serious and intriguing as those that faced the closed college. For example:

- What current policies tend to hinder the college's ability to open itself to students and to resources? financial aid? budgeting? faculty rewards?
- What should academic *community* be for, and be like, as the college spreads beyond the boundaries of a campus?
- What should resources the college own, and which of those should it share with others?

Stay tuned.

*****

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Figure 1

Supporting the Four Conversations		
Type of Conversation	**Examples of Traditional Technologies**	**Examples of Newer Technologies**
Study of Direct Instruction	Lecture Hall, Textbook, Handouts, Overhead projector	Video tape and disc, computer-aided instruction; electronic mail
Real-Time Conversation With Other People	Seminar Table; blackboard where students can show how they work on problems	Audiographic conferencing; telephone; two-way video; text "chat" on network
Time-Delayed Conversation With Other People	Living near faculty so papers can be handed back and forth	Fax machine; file transfer; computer conferencing; exchange of papers on file server; shared hypertext
Learning by Doing (action in realistic situations; reflection)	Typewriter; sliderule; library and its books; laboratory and its equipment; internships programs	Word processor; statistical software; online library; CD-ROM database; realistic simulations

Figure 2

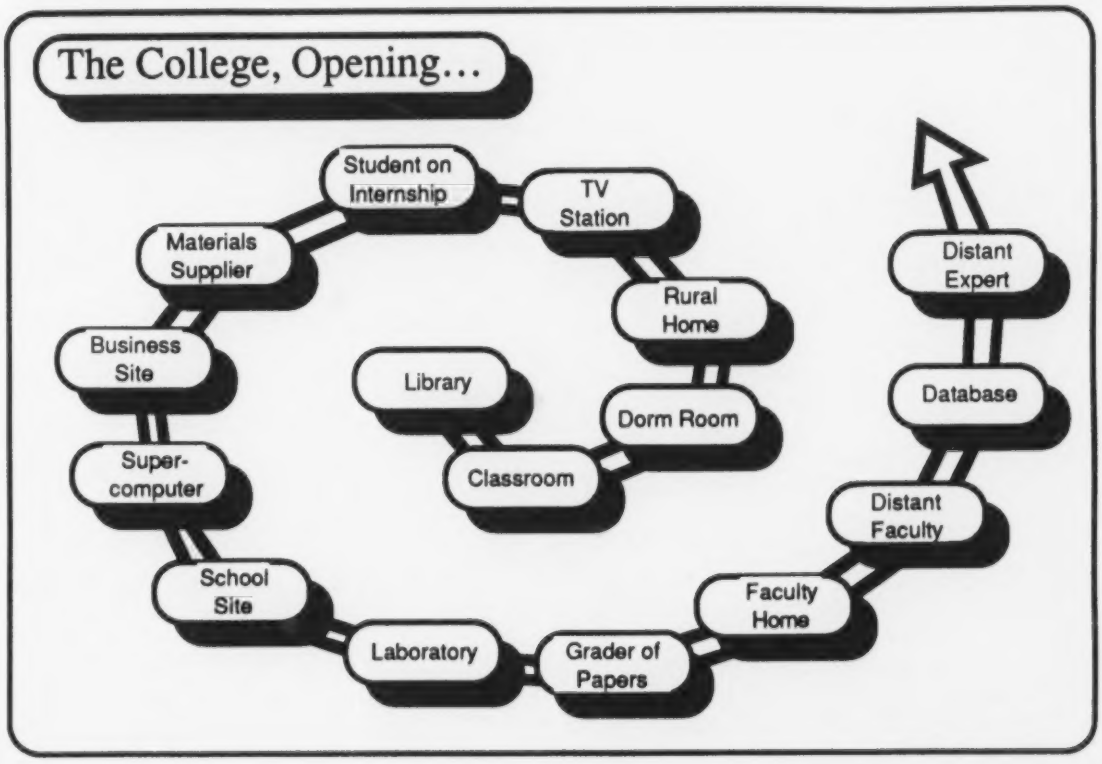
The College, Opening...
Student on Internship
TV Station
Materials Supplier
Rural Home
Business Site
Library
Dorm Room
Super-computer
Classroom
School Site
Laboratory
Grader of Papers
Faculty Home
Distant Faculty
Database
Distant Expert

Figure 3

The Annenberg/CPB Project

The Annenberg/CPB Project was established to make it possible for more people to pursue a baccalaureate-level education by taking advantage of opportunities provided by electronic technologies. Launched in 1981, the Project has received funding of $10 million a year, provided by The Annenberg School of Communications to the Corporation for Public Broadcasting.

To achieve its goal, the Project has provided support to develop imaginative, academically rigorous course materials and to explore new applications of information and telecommunication technologies. Many of its projects have been spotlighted in previous editions of *Academic Computing*, including the PERSEUS database on classical Greece, MECHANICAL UNIVERSE physics tapes and videodiscs, the ENFI approach to teaching writing over a local area network, and the MIT Athena Language Learning Project.

The Project is currently sponsoring a new funding Initiative called "New Pathways to a Degree: Using Technologies to Open the College." The Project seeks proposals from a range of 2- and 4-year colleges and universities that would use technologies to make academic programs more accessible to more types of students. The Initiative will also help the Pathways colleges work together on policy issues, evaluation, and dissemination.

Note: The opinions expressed in this article do not necessarily reflect funding priorities of the New Pathways Initiative or of the Annenberg/CPB Project.